FCC Verification Report
For a Class B Digital Device

Client:

ADI Engineering, Inc.
1758 Worth Park
Charlottesville, VA 22911

Phone 434-978-2888

Device Under Test:

Cinnamon Bay SBC A5x0P

Document Number: 2009217
Reference Number: QRTL09-270

Test Results: PASS

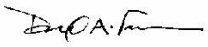
This report may not be reproduced, except in full, without the written approval of Rhein Tech Laboratories, Inc.

Test Overview:

Model No.:	Cinnamon Bay SBC A5x0P
Manufacturer's Name:	ADI Engineering, Inc.
Manufacturer's Address:	1758 Worth Park Charlottesville, VA 22911
Manufacturer's Contact:	Tom Brown
Type of Equipment:	Single Board Computer
Serial No.:	N/A
Year of Manufacture:	2009
Location of Testing:	Rhein Tech Laboratories, Inc., Herndon, VA
Date of Receipt:	July 14, 2009
Date(s) of Testing:	July 14, 2009
Purpose of Testing:	FCC Class B Compliance

Standard(s) to which device was tested:

Standards	Specific Tests	Applicability ☒ *Tested* ☐ *Not Tested*	Result
CFR47 Part 15.109	Radiated Emissions	☒	Pass
CFR47 Part 15.107	Conducted Emissions	☒	Pass

Test Engineer:	Jon Wilson	**Signature:**	
Report Written By:	Jon Wilson	**Signature:**	
Report Approved By:	Desmond Fraser	**Signature:**	
Report Number:	2009217		
Report Date:	July 24, 2009		

Accredited under A2LA Certificate # 2653.01
Note: This report may not be used by the client to claim product endorsement by A2LA or any agency of the U.S. Government.

TABLE OF CONTENTS

1 GENERAL INFORMATION 4

1.1 ACCREDITATION STATEMENTS 4
1.2 DEVIATIONS 4

2 SYSTEM TEST CONFIGURATION 5

2.1 PRODUCT DESCRIPTION 5
2.2 EUT EXERCISE DESCRIPTION 7
2.3 MODIFICATIONS 8
2.4 EQUIPMENT UNDER TEST 8
2.5 CONFIGURATION OF DEVICE UNDER TEST 9

3 LABELLING/ STATEMENTS 10

3.1 LABEL ON DEVICE 10
3.2 STATEMENT IN USER'S MANUAL 10

4 CONDUCTED EMISSIONS 11

4.1 SITE AND TEST DESCRIPTION 11
4.2 MEASUREMENT UNCERTAINTY 11
4.3 CONDUCTED EMISSIONS DATA 12
4.4 CONDUCTED TEST PHOTOGRAPH 13

5 RADIATED EMISSIONS 14

5.1 SITE AND TEST DESCRIPTION 14
5.2 MEASUREMENT UNCERTAINTY 14
5.3 FIELD STRENGTH CALCULATION 15
5.4 RADIATED EMISSIONS DATA 16
5.5 RADIATED TEST PHOTOGRAPHS 17

6 EQUIPMENT LIST 18

1 GENERAL INFORMATION

The following test report for a Class B digital device is prepared on behalf of **ADI Engineering, Inc.** in accordance with Part 2, and Part 15, Subparts A and B of the Federal Communications Commissions Rules and Regulations. The Equipment Under Test (EUT) was the **Cinnamon Bay SBC A5x0P.** The test results reported in this document relate only to the items that were tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 2003. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. Calibration checks are performed regularly on all test equipment.

All radiated and conducted emission measurements were performed manually at Rhein Tech Laboratories, Inc. The radiated emissions measurements were performed on the (three/ten) meter, open field, test range maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Va., 20170. Complete description and site attenuation measurement data has been placed on file with the Federal Communications Commission. The power line conducted emission measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. Rhein Tech Laboratories is accepted by the FCC as a facility available to do measurement work for others on a contract basis.

1.1 ACCREDITATION STATEMENTS

- A2LA (USA): Accredited under A2LA Certificate # 2653.01
- FCC (USA): Listing of test sites, Registration # 90902
- IC (Canada): Listing of test sites, IC 2956-1 and IC 2956-2
- US TCB (ATCB): Certification of cooperation, granted in 2005
- US CAB: Australia, Canada, China, Korea, accepted CAB under Phase I of APEC Telecommunication MRA. Identification number US0079
- VCCI (Japan): Approval and registration of RTL test sites as R-1113 and C-1172

1.2 DEVIATIONS

There were no deviations from the test standard(s) and/or methods.

2 SYSTEM TEST CONFIGURATION

2.1 PRODUCT DESCRIPTION

ADI Engineering's Cinnamon Bay Single Board Computer (SBC) product line is a family of full-function SBCs for the Intel® Atom Z510P, Z530P and Z520PT processors. The Cinnamon Bay SBC family consists of three models targeting a wide range of deeply embedded applications such as IP media, military, medical, wireless access, industrial controls, general-purpose embedded computing, digital signage, gaming, and point of sale (PoS) terminals.

The basic Cinnamon Bay SBC architecture is illustrated in the block diagram below.

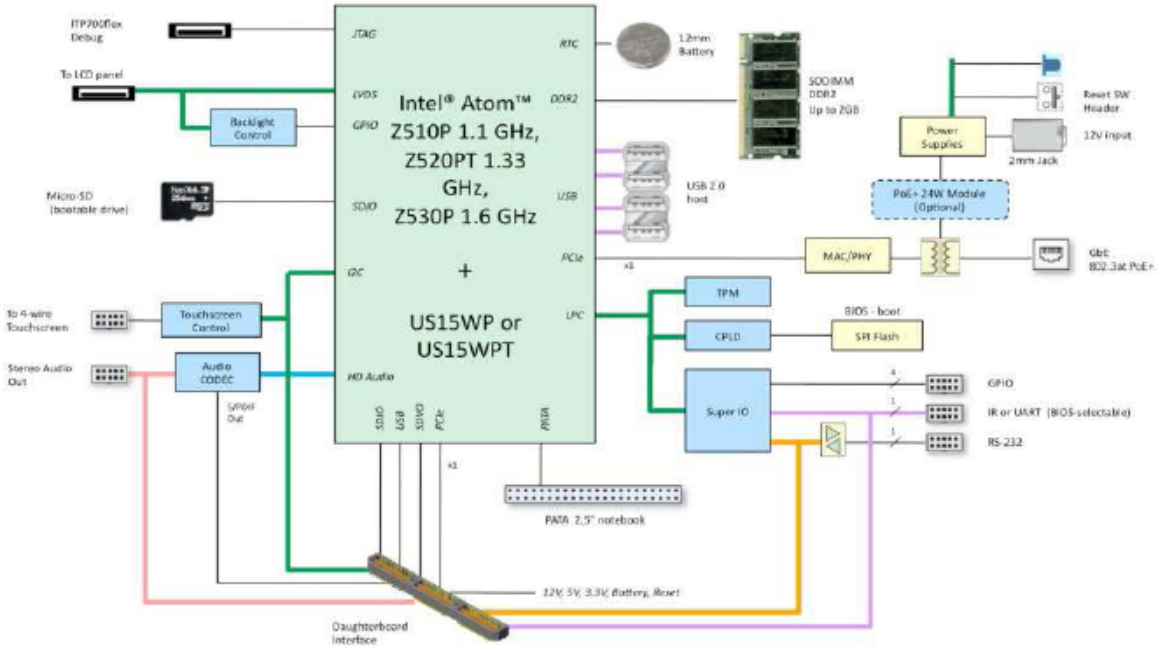


Figure 1 CB SBC System Block Diagram

Feature	CB SBC A530P	CB SBC A510P	CB SBC A520 EXT (Extended Temperature)
Form Factor	88 x 110mm		
CPU	Intel® Atom Z530P, 1.6 GHz	Intel® Atom Z510P, 1.1 GHz	Intel® Atom Z520PT, 1.33 GHz, extended
System Controller Hub (SCH)	Intel US15WP		Intel US15WPT, extended temperature
System Memory	DDR2 SO-DIMM socket, supporting 256MB - 2GB		
Ethernet	One RJ45 Gigabit Ethernet port (connector on board)		
USB 2.0 Host	Four (connectors on board)		
Bootable MicroSD	One (connector on board)		
Boot Flash	16Mbit Serial Boot Flash		
Trusted Platform Module	Yes		Yes
Video	LVDS (connector on board)		LVDS (connector on board)
4-wire Touchscreen Controller	Yes (via header)		Yes (via header)
LCD Backlight Power (5V, 3.3V)	Yes (connector on board)		Yes (connector on board)
802.3at Draft 3.0 PoE+	Via ADI's optional PoE+ module • 1500VRMS electrical isolation • 24W total power output when connected to a PoE+ power injector • 20W available for your peripherals Backwards compatible with 802.3af power injectors (contingent on sufficiency of the lower 802.3af limit in powering user-supplied peripherals)		
12V Power Input Jack	Yes (connector on board)		
PATA 2.5" HDD Connector	Yes (connector on board)		
RS-232	1 header		1 header
IR Port / UART (BIOS Selectable)	1 header		1 header
ADI daughterboard connector	1 header		1 header
Audio	Intel HD Audio CODEC, with stereo line out (via header)		Intel HD Audio CODEC, with stereo line out (via header)
Discrete I/O	4 bits via header		4 bits via header
Voltage and Temperature Monitor	Yes (connector on board)		Yes (connector on board)
Battery-Backed Real-Time Clock	Yes (accurate within 20 ppm)		
On-Board Hardware Watchdog Timer	Yes		Yes
LEDs	Power, Hard Drive		
External Reset	Pushbutton		
ITP700Flex Debug connector	Yes (connector on board)		
Operating Temperature Range	0 to 70C	0 to 70C	-40 to 85C
Power Consumption	15 Watts for Cinnamon Bay SBC with 15" LVDS flat panel monitor and 2.5" PATA HDD (no daughter cards)		

2.2 EUT EXERCISE DESCRIPTION

- A high-end Cinnamon Bay SBC (A530P) will be used for all FCC test runs since it is the highest speed SBC in the product line.
- The SODIMM memory slot will be populated with a 1GB, DDR2 module capable of running at a 533MHz data rate (267MHz clock).
- The four USB ports will be connected to loopback "pods" using standard off the shelf USB cables of at least 1m in length.
- A CAT5e patch cable longer than 1m will be used to connect the SBC's Ethernet port to a small switch.
- The Cinnamon Bay SBC will drive a 15" TFT Flan Panel display via the LVDS connector on the SBC.
- A 2.5" laptop style hard disk drive will be connected to the SBC's PATA interface. The hard drive will contain a Windows XP installation along with "BurnIn Test" from PassMark Software. Additionally, the hard drive will contain a VNC server installation so the system under test can be controlled via a remote terminal.
- For the initial test run, the Cinnamon Bay SBC will be powered via a POE daughter board. The POE daughter board is connected to a POE injector. If this combination is too noisy, the power source will be switched to a "Wall Wart" style power brick.
- Onboard headers are populated for development and debug purposes and therefore are outside the scope of testing a realistic field application.
- A host PC/laptop with a VNC viewer application will be attached to the same switch as the SBC. The VNC view will be used to provide mouse and keyboard functionality necessary to launch the test software.

"BurnIn Test" from PassMark Software will be used to exercise the processor on the SBC and its major peripherals. The table below outlines the manner that the Cinnamon Bay SBC is exercised during the FCC test.

SBC Component	Tests Executed
Processor	The primary method for exercising the processor is by continually executing both integer and floating point math tests. Testing the other SBC features will provide additional loading on the processor. Throughout the test, CPU utilization will be kept near 100% (as reported by the BurnIn Test application).
Memory	The memory test works by writing a pattern in RAM, then verifying the contents read from RAM match what was written. The pattern written will change from one cycle to the next. Any RAM not in active use by Windows will be grabbed by the memory test.
Ethernet	The Ethernet port will be exercised using both internal and external loopbacks. For the external loopback, a packet is sent to a remote host and echoed back. The packet sent to the remote host contains a data payload and a checksum. Every time a packet is echoed from the remote host the checksum is verified and the data payload is compared byte by byte with the data that was sent. The data payload is 64 bytes in length.
USB	Testing the 4 USB ports on the Cinnamon Bay SBC requires 4 loopback plugs from PassMark Software. The USB test sends data to the USB loopback plugs in 0.5KB blocks. The USB loopback plug receives the data, copies it to a new buffer and transmits it back to the SBC. The SBC compares the data in the block for an exact match, and then builds a new packet of random data bytes. Any differences between the data sent and received is flagged as an error.
Hard Disk Drive	During each test cycle, a file is created and verified on the HDD. The size of the file transferred is equal to 1% of the size of the disk (i.e. for a 30GB hard drive, the file size is 300MB). Each test file is filled with a number sequence (pattern) that is used to verify the correct operation of disk when the file is read. Files are created on the HDD until the disk is 94% full. When the disk has reached the 94% full limit, all the test files are deleted and the test starts again.
MicroSD	Same test method as for the Hard Disk Drive
Display	The "BurnIn Test" software will launch a window for each of the tests described above. Each window continually updates as the test progresses. Additionally, an analog style clock window is launched to provide a visual indication that the display is updating as expected (not locked up).

2.3 MODIFICATIONS

Installed ferrite on DC input. 600 Ohm Steward 24V2220-ISO

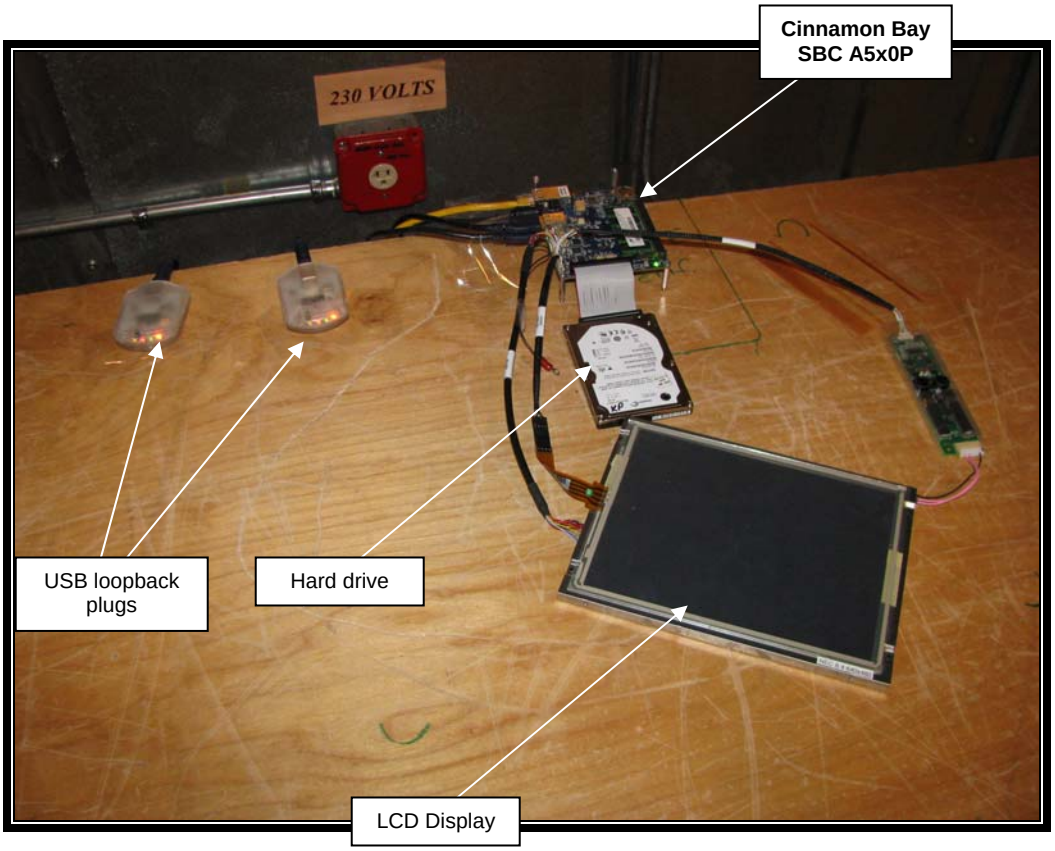
2.4 EQUIPMENT UNDER TEST

Listed below are the identifiers and descriptions of all equipment used with the EUT for this test.

Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code	Equipment Arrival Date
Single Board Computer	ADI Engineering, Inc.	Cinnamon Bay SBC A5x0P	N/A	No	Unshielded power	N/A	July 14, 2009

2.5 CONFIGURATION OF DEVICE UNDER TEST



3 LABELLING/ STATEMENTS

3.1 LABEL ON DEVICE

The device under test shall bear the following label in a conspicuous location:

> This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

3.2 STATEMENT IN USER'S MANUAL

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

> NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
>
> —Reorient or relocate the receiving antenna.
> —Increase the separation between the equipment and receiver.
> —Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
> —Consult the dealer or an experienced radio/ TV technician for help.

4 CONDUCTED EMISSIONS

4.1 SITE AND TEST DESCRIPTION

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm/50 microhenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. Video filters less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded.

4.2 TEST LIMITS

Class A Line-Conducted Emissions		
	Limit (dBµV)	
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	79	66
0.50 to 30.0	73	60

Class B Line-Conducted Emissions		
	Limit (dBµV)	
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

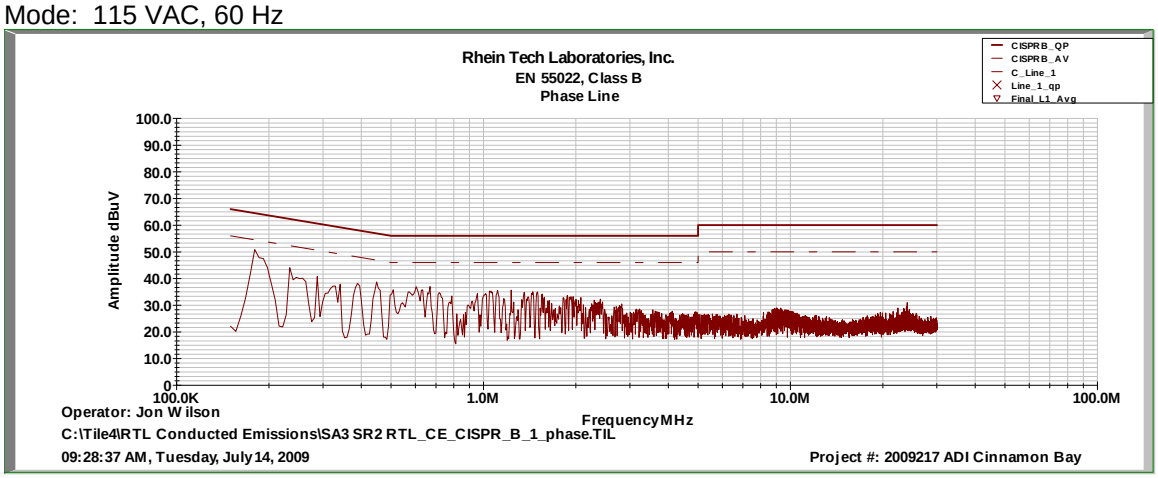
4.3 MEASUREMENT UNCERTAINTY

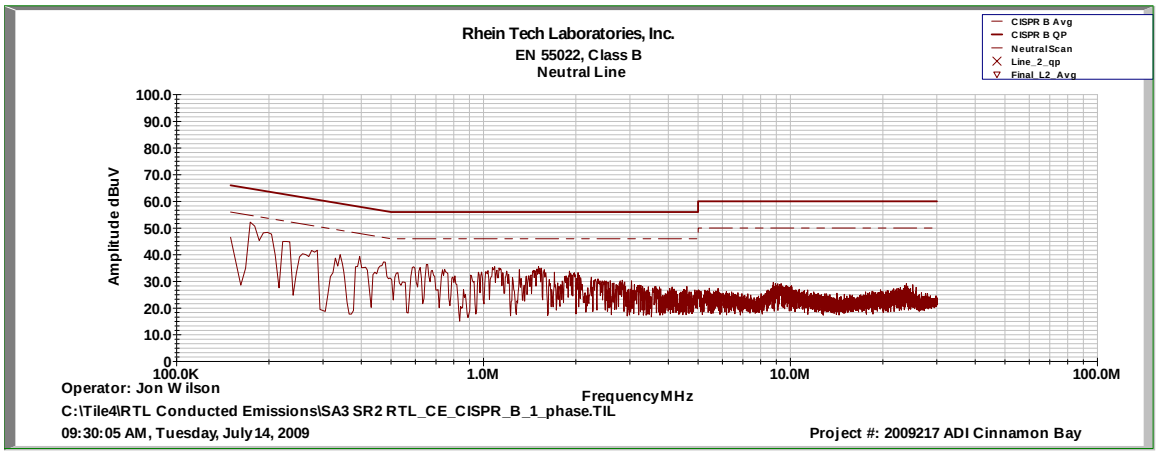
Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Conducted Emissions: + 4.1 dB and – 3.6 dB

4.4 CONDUCTED EMISSIONS DATA

Mode: 115 VAC, 60 Hz





Result: Pass

Test Personnel:

Jon Wilson		July 14, 2009
Tester	Signature	Date of Test

4.5 CONDUCTED TEST PHOTOGRAPH

5 RADIATED EMISSIONS

5.1 SITE AND TEST DESCRIPTION

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoor at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meter above the ground plane. The spectrum was examined from 30 MHz to 2,000 MHz.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, measurement use an average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

5.2 MEASUREMENT UNCERTAINTY

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Radiated Emissions: + 5.0 dB and – 4.3 dB

5.3 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FI(dBµV/m) = SAR(dBµV) + SCF(dB/m)
FI = Field Intensity
SAR = Spectrum Analyzer Reading
SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

SCF(dB/m) = - PG(dB) + AF(dB/m) + CL(dB)

SCF = Site Correction Factor
PG = Pre-amplifier Gain
AF = Antenna Factor
CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(\mu V/m) = 10^{FI(dBuV/m)/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

49.3 dBµV - 11.5 dB = 37.8 dBµV/m

$$10^{37.8/20} = 10^{1.89} = 77.6\ \mu V/m$$

5.4 RADIATED EMISSIONS DATA

Temperature: 75°F Humidity: 34%											
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail	
50.290	Qp	V	75	1.0	43.9	-23.6	20.3	30.0	-9.7	Pass	
70.810	Qp	V	260	1.0	46.8	-26.3	20.5	30.0	-9.5	Pass	
79.090	Qp	V	45	1.0	42.0	-25.4	16.6	30.0	-13.4	Pass	
91.360	Qp	V	170	1.0	37.0	-22.7	14.3	30.0	-15.7	Pass	
116.100	Qp	V	210	1.0	38.8	-19.6	19.2	30.0	-10.8	Pass	
133.210	Qp	V	90	1.5	41.4	-20.4	21.0	30.0	-9.0	Pass	
144.000	Qp	V	170	2.0	41.6	-20.5	21.1	30.0	-8.9	Pass	
166.000	Qp	V	10	2.0	42.3	-20.7	21.6	30.0	-8.4	Pass	
183.195	Qp	V	180	1.0	40.0	-21.2	18.8	30.0	-11.2	Pass	
199.152	Qp	H	180	4.0	46.0	-20.9	25.1	30.0	-4.9	Pass	
226.415	Qp	V	20	1.0	40.4	-21.1	19.3	30.0	-10.7	Pass	
299.870	Qp	V	45	1.0	44.7	-16.9	27.8	37.0	-9.2	Pass	

Note: Test distance 10m

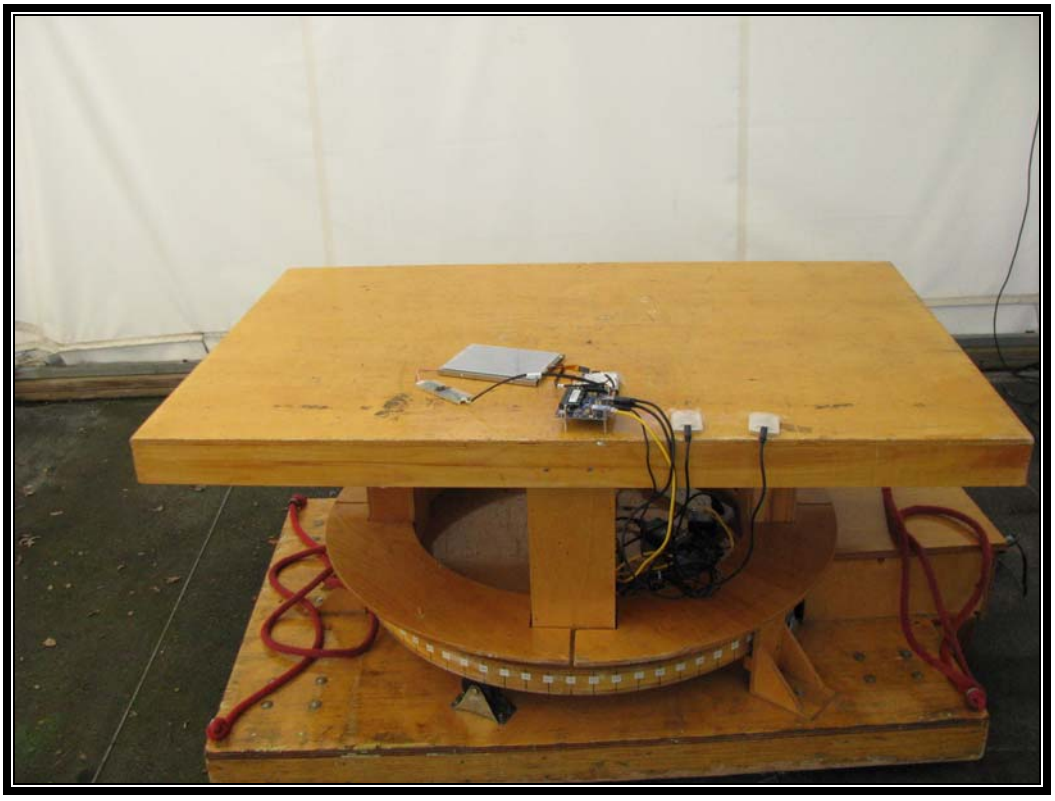
Note:
The EUT was scanned from 30 MHz to 2,000 MHz. All emissions other than those listed in the table above were found to have amplitudes attenuated by more than 20dB below the FCC limit.

Result: PASS

Test Personnel:

Jon Wilson		July 14, 2009
Tester	Signature	Date of Test

5.5 RADIATED TEST PHOTOGRAPHS



6 EQUIPMENT LIST

The following is the list of equipment Rhein Tech used to perform testing.

Part Type	Manufacturer	Model	Serial Number	Barcode	Cal Due Date
Conducted Emissions					
Spectrum Analyzer (100Hz-.15GHz)	Hewlett Packard	8567A	2602A00160	900968	9/8/2009
Spectrum Analyzer Display Section	Hewlett Packard	85662A	2542A11239	900970	9/8/2009
Quasi-Peak Adapter	Hewlett Packard	85650A	2521A00743	900339	9/11/2009
Filter	Solar	8130	947306	900729	8/19/2009
16A LISN	AFJ International	LS16/110VAC	16010020081	901083	10/23/2009
Emissions testing software	Quantum Change	Tile!	4.0.A.8	N/A	N/A
Radiated Emissions (OATS1)					
Amplifier (20MHz-2GHz)	RTL	PR-1040	900905	900905	6/2/2010
Bi-Log Antenna (20MHz-2GHz)	Schaffner Chase	CBL6112B	2099	900791	12/12/2010
EMI Receiver RF Section, 9 KHz - 6.5 GHz	Hewlett Packard	85462A	3325A00159	900913	4/15/2010
RF Filter Section, 100 KHz to 6.5 GHz	Hewlett Packard	85460A	3330A00107	900914	4/15/2010
Emissions testing software	Rhein Tech Laboratories, Inc.	Automated Emission Tester	Rev. 14.0.2	N/A	N/A